Editorial

Industrial Ecology and LCM: Chicken and Egg?

John R. Ehrenfeld

Executive Director International Society for Industrial Ecology

Director Emeritus, MIT Technology, Business and Environment Program, 24 Percy Road, Lexington, MA 02421, USA (John.Ehrenfeld@alum.mit.edu)

For some three decades, concerns about environment and, more recently sustainability, have spawned new ideas, policies and strategies, tools, and technologies. Observers of changes in these categories note several important trends, for example, a move from command-and control of production to a market-based system. Another trend is a broadening of focus from the production side only to include product systems under the policy makers' or designers' microscope. This move is just one aspect of a more fundamental shift – a broadening of boundaries towards a larger systems context. LCA and LCM represent steps along the path to such a systems view. At the same time that these two concepts developed, so did another systems-oriented idea, industrial ecology, taking its basic framework for analysis and design from natural ecological systems. Its evolution has roots in several fields and disciplines including economics, biology, engineering, thermodynamics, and more. The strongly interdisciplinary character of industrial ecology creates overlaps with these related fields and with distinctive methodological areas, such as LCA or LCM. To get the most out of work in any of these, it is very important to promote communication and collaboration among researchers and practitioners. Joint meetings, like the one organized in Barcelona in December 2002 by SETAC and the International Society for Industrial Ecology[1], can facilitate productive overlap and cross-talk, and help prevent the formation of hard boundaries.

The recent move by SETAC and this Journal into life cycle management (LCM) intensifies the need to keep communication channels open. A recent editorial by the editors of this journal [1] pointed to the expansion of the content to include LCM. In doing so they noted, "LCM is a concept rather than a method or a tool..." They went further and said, "The relation between the concept and the tools...deserves a thorough and critical discussion." Editorials are not the place for thorough investigations, but can serve to examine critical issues. As concepts or as frameworks for practice, LCM and industrial ecology need to be distinguished from the tools that their practitioners employ.

Let me begin with industrial ecology. Its origins are somewhat fuzzy, but most agree that the concepts that constitute the field arose from observers noting that flows of energy and materials in industrial economies have many features analogous to similar flows in ecological systems. Early researchers used the term industrial metabolism, again suggestive of a living system [2]. This ecological metaphor has produced two more or less separate sets of practice. The first, industrial ecology's objective side, is that of researchers and analysts trying to gain a better and deeper understanding of industrial economies. They have developed tools along the way, for example, material flow accounting (MFA) and substance flow analysis (SFA). The analytic usefulness of the systems framework of industrial ecology has become apparent to planners and policy-makers charged with developing national and regional polices. Standard policy-making has generally ignored material flows, and is inadequate when addressing environmental resource issues and sustainability.

A second, normative, as opposed to objective, aspect can be found in the work of others within the industrial ecology community who see its concepts, particularly the ecological metaphor, as a framework for designing (more) sustainable societies. For them, natural systems can be seen as examples of sustainability showing robustness over long periods of time in ways not yet seen in human systems. The critical difference in this second manifestation of the concept is that the actors are involved in design rather than in normal, everyday activities. I believe that this distinction is very important.

For me design is a special activity to be distinguished from the everyday business-as-usual work we all do in our firms, universities, homes and so on. Normal activities are those we enter into routinely expecting that the tools we have available will function smoothly and produce whatever outcomes we have in mind (intend) at the time. We analyze and make decisions based on the tools' outcomes. Excellent organizations and competent actors always have a full toolbox at hand so that, if one tool fails to work, they can readily pick up another. LCA, MFA, SFA are such tools. Managers, engineers, analysts and others use them to answer specific questions: for example, given two product designs, which is the better according to some set of environmental criteria. They produce metrics that help people judge how close they are to where they intend to be. It is often said that what cannot be measured cannot be managed.

True enough, but management is not design. LCA is not the same as eco-design although it is an essential part of the process. Eco-designers first need to synthesize and create new artifacts and artifactual systems before analyzing them to see if they are indeed improvements. An LCA may point to places along the product chain where improvements are most needed, but it cannot tell the designer how to make them happen. Except for what is normally considered to be fashion designing, design comes about when actors become unable to satisfy their routine, intentional desires by applying their existing toolboxes within the context of their current beliefs. Faced with such impasses, designers seek solutions to current problems or search out paths to new worlds by making metaphorical jumps to create new rules that are not available in their at-hand world. Although design is usually connected to the creation of artifacts, I would also consider the development of strategies,

[1] 10th LCA Case Studies Symposium: 'Recycling, close-loop economy, secondary resources' and 'Industrial ecology: From theory to practice,' organized by SETAC Europe and ISIE, December 2–4, 2002, Barcelona, Spain

policies, and infrastructural networks in which artifacts live out their life cycles as design.

Designers employ both metrics and metaphors in their work. But without the metaphors, their work is essentially engineering, working within an established set of law-like rules [3]. Sustainability poses extraordinary difficult demands on designers today. Global trends indicate that our traditional rules for technological innovation, corporate strategies and public policies are moving us in the wrong direction. New metaphors are needed. In this regard, industrial ecology, in my opinion, is very powerful. It draws on the ecological metaphor, which offers to designers ideas distinct from those within their standard paradigms. These ideas are simple and are already being used to design policies, strategies, and industrial complexes. The metaphorical aspects of industrial ecology include the notion of closing cycles, new forms of cooperative relationships in place of the competitive model of liberal markets, and the importance of (holistic) communities. All of these features can be found in symbiotic communities like Kalundborg, Denmark where one observes virtually no waste being accumulated [4]. Process byproducts are interchanged as feedstocks among the companies.

The ecological metaphor of industrial ecology can be found in other concepts for designing sustainable systems, for example, Biomimicry, The Natural Step, the McDonough-Braungart principles, and much of Natural Capitalism. At the risk of offending some readers of this Journal, I would argue that LCM also fits under the metaphorical umbrella of industrial ecology. LCM reflects the interconnectedness of industrial systems and the general need to close material cycles in designing sustainable societies. Analysts can use its tools to sort among alternative product/service management systems to discover the best of a set of alternatives. But, like MFA or LCA, even as a more robust toolbox, as it has been called [5], LCM has limited power to turn on the creative juices of a designer. At this stage in the evolution of the concept, LCM remains tied closely to LCA and retains much of its metrical sense. To become a powerful input to design, LCM must acquire a metaphorical sense. My guess is that such a sense can be found within the normative side of industrial ecology.

But what I think is not important. What is important is that all of these ideas continue to be developed together in a rich context of intellectual dialogue and growing number of practical applications. Benjamin Franklin said at the signing of the American Declaration of Independence, "We must all hang together, or assuredly we shall all hang separately." Given the criticality of re-designing much of the world's institutions and technological systems to achieve a world that is sustainable, his words remain a clear message to all of us today.

References

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